

REMARKS

Claims 1-21 are pending. Claims 22-28 are canceled.

Applicants have amended claims 15 and 18 to proper dependent form. Applicants have also amended claim 17 to clarify that the invention encompasses processes wherein the ratio of solvent burn is 0.80 moles of COx per mole of teraphthalic acid produced or less. Support for this amended may be found on page 11, lines 17-19.

Claims 15 and 18 stand objected to because of informalities. Claim 15 has been amended to be properly dependent upon claim 1. Claim 18 has been amended to be properly dependent upon claim 17. Applicants submit that these are appropriate corrections to overcome Examiner's objections.

Claims 1-21 stand rejected under 35 USC § 112 as being indefinite because the phrases "substantially free of," and "incompletely oxidized reaction products comprising" are recited. For the reasons which follow, Applicants submit that these phrases are definite.

The phrase "substantially free of" is not uncommon language. The phrase "substantially free of" is less than an amount of zirconium which increases solvent burn, and in this case, which increases solvent burn by more than 10 % relative to the same catalyst composition devoid of zirconium. Support for this definition may be found on page 8, lines 15-29.

"Reaction products comprising 4-carboxybenzaldehyde compounds" are definite because "comprising" modifies "reaction *products*" rather than a reaction *product* in the singular. There can be a variety of incompletely oxidized reaction products present, among which is at least 4-carboxybenzaldehyde compounds. Comprising is indeed an open-ended term, and in this case the word comprising calls for at least one of the many products to be 4-carboxybenzaldehyde compound. It is submitted that this phrase is definite and clear. For these reasons, Applicants respectfully request withdrawal of the rejection of claims 1-21.

Claims 1-6 and 8-12 are rejected under 35 USC § 102(b) as being anticipated by Partenheimer et al., US 4,786,753. The Examiner points to Table II for support of the rejection. For the reasons which follow, Applicants submit that Partenheimer et al. do not anticipate the rejected claims.

Claim 1 calls for, among other things, conducting the oxidation reaction at a temperature in a range of 120° C to 250° C. The oxidation reaction described in Table II was conducted at 95° C. See subscript "a" beneath Table II which describes the reaction conditions for the oxidation reaction of Examples 15-18. For this reason, the Working Examples 15-18, specifically example 17, do not anticipate the process of claim 1 because they do not disclose conducting a reaction at a temperature in a range of 120° C to 250° C.

Reliance was placed upon Column 2, lines 65-66 for support that the reaction for Example17 was conducted at 160° C. However, Column 2, lines 65-66 do not describe the suitable temperatures for p-xylene. Column 2, lines 65-66 only states that the oxidation reactions were conducted "to the desired temperature, 160° C for pseudocumene, and then..." The reference to 160° C was directed to the reaction conditions set for the oxidation of pseudocumene, not p-xylene or m-xylene. The oxidation reaction for m-xylene and p-xylene was, according to Table II, conducted at 95° C. For this reason, Partenheimer, et al. do not anticipated any of the rejected claims, and Applicants respectfully request withdrawal of the rejection.

Applicants also wish to direct the Examiner's attention to the uncertainty surrounding the data in Table II, which casts serious doubt on whether those of ordinary skill would readily envisage the claimed invention as required to support a rejection under 35 USC § 102 (b). Specifically, footnote "a" underneath Table II, which describes the reaction conditions for Examples 15-18, refers to Example 17 and 18 as oxidizing 15.0 ml p-xylene, and Examples 19 and 20 as oxidizing 15 ml m-xylene. This cannot be correct because Examples 19 and 20 are not in Table II and actually fall under Table III, which describes the oxidation of pseudocumene. It is possible that what was actually intended was to describe Examples 15 and 16 as an oxidation in 15 ml of p-xylene, and Examples 17 and 18 as an oxidation in 15 ml of m-xylene. Regardless of what was

intended, the error and ambiguity of intent precludes a finding of anticipation with respect to conducting example 17 as an oxidation in p-xylene.

Another error noted in Table II lies with respect to the amount of bromine identified in Example 17 as 2.01 moles. It is believed that this in fact a typographical error because at Column 4, lines 24-28, the Patentee notes that:

> It is therefore important when determining if a synergistic interaction has occurred, to be sure that *equal catalyst* concentrations are being compared. In the following examples this proviso *has been observed*. [Emphasis added].

Further, it was also noted that:

> "in Table I the experimental data as set forth where pseudocumene was the oxidant while in Table II p-xylene and m-xylene were the oxidants. The synergistic effect of zirconium on Ni/Mn/Br catalyst was observed with all of these feedstocks." Column 4, lines 46-50.

Thus, according to Partenheimer et al., the catalyst concentration across Examples 15-18 should have been kept the same in order to evaluate whether zirconium did or did not have a synergistic effect on the oxidation rate. Specifically, footnote "a" underneath Table II states that :

> "Reactions [examples 15-18] were run in a glass reactor containing 2.01 mmole cobalt (II) acetatetetrahydrate, 2.01 mmole manganese (II) acetatetetrahydrate, 4.00 mmole sodium bromide, and 100.0 ml. acetic acid."

For this reason, it is believed that those of ordinary skill, reading Example 17, would have believed that the designation of 2.01 moles for the bromide was an error, and should have been stated as 4.01 as in Examples 15, 16, and 18.

Thus, for these additional reasons, at a very minimum Table II is ambiguous at best, and therefore, would not have anticipated the claims. Those of skill in the art would not have readily envisaged the claimed invention by the data set forth in Example 17 in that Example 17 does not:

1. have an oxidation at a temperature in the range of 120° C to 250° C,

2. does not clearly and unambiguously describe the oxidation of p-xylene,
3. does not clearly and unambiguously describe the molar ratio of bromine atoms to manganese atoms of 1.5 or less.

Accordingly, Applicants respectfully request withdrawal of the rejection thereof.

Claims 1-21 stand rejected under 35 USC § 103(a) as being unpatentable over Partenheimer et al. in view of Vynne Norval et al., EP 0041784. For the reasons which follow, Applicants submit that the claims are patentable over these two references.

Partenheimer et al. is alleged to expressly teach "the method of producing terephthlate acid by oxidizing p-xylene in the presence of a catalyst composition comprising Ni, Mn, and bromine at a pressure of 150 psig and at a temperature of 160° C." This is incorrect for the reasons which follow.

Partenheimer et al. suggests, and even requires, the presence of zirconium in the catalyst system in order to improve the oxidation rate of p-xylene, m-xylene and pseudocumene. Partenheimer et al. would not have suggested the claimed invention because the claimed invention calls for a catalyst system that is substantially free of zirconium atoms. This feature is not suggested by Partenheimer et al., and in fact, Partenheimer et al. teach against a catalyst system that is substantially free of zirconium atoms. Partenheimer et al. also do not teach or suggest suitable oxidation temperatures when using a catalyst system that is substantially free of zirconium atoms. The only oxidation temperature taught as suitable in the system oxidizing p-xylene, more specifically for oxidizing p-xylene in the presence of a catalyst system that is substantially free of zirconium atoms, is at a temperature of 95° C. By increasing the oxidation temperature, the rate of acid burn will also increase, all other things being equal.

Thus, the deficiencies in Partenheimer et al. are not only with respect to the content of 4-CBA, or the claimed ratio of solvent burn, but also in that Partenheimer et al. do not suggest the oxidation of p-xylene at a temperature of 120° C to 250° C in the presence of a catalyst system substantially free of zirconium atoms. Moreover, for the reasons noted above with respect to the deficiencies of Table II, it is doubtful that those of ordinary skill in the art would have been informed by Example 17 conducting

the oxidation in p-xylene, at the claimed temperatures, or that the stated amount of bromine is correct.

Finally, it must be borne in mind that the only teaching relied upon to support an obviousness rejection is a *comparative* example, and that the only teachings within Partenheimer et al. which would suggest a modification of a comparative example in order to improve the oxidation rate is to employ zirconium atoms. The fact that Example 17 is a comparative example is powerful evidence pointing away from and teaching against the use of a Ni/Mn/Br catalyst system, and does not provide any teaching whatsoever on how to modify that composition catalyst system in a manner other than by addition of zirconium atoms.

Vynne Norval, et al. is alleged to teach that it is "possible to control the content of 4-CBA of the crude terephthalic acid by oxidizing p-xylene in a liquid phase oxidation in the presence of heavy metal catalysts." However, for the reasons which follow, it is submitted that Vynne Norval, et al. is not combinable with Partenheimer et al., and that in any event the combination thereof would not have suggested the claimed invention.

Vynne Norval, et al. is directed to solving the problem of using water as a solvent to obtain an acceptable product:

> The effect of the present invention is to select the conditions under which the process is operated, particularly with respect to temperature and choice of catalyst, that water may be used as solvent and an acceptable product obtained." See page 1, lines 26-30.

On the other hand, Partenheimer et al. is directed to solving the problem of improving the oxidation rate of an oxidizable compound, and solves this problem by incorporating zirconium atoms. Thus, those of ordinary skill interested in improving the oxidation rate of an oxidizable compound would not have looked to the teachings of Vynne Norval, et al., and those interested in the use of water as solvents or increasing the amount of water as a solvent in an oxidizable mixture would not have looked to the teachings of Partenheimer et al.

It is also submitted that the teachings of Partenheimer et al., and Vynne Norval et al., are incompatible because, as noted in the working example of Vynne Norval et al,

the oxidation is conducted in the presence of water as a solvent, while working examples of Partenheimer et al. use acetic acid. The particular reaction conditions which would be suitable in a solvent system exclusively containing water are not the same as the reaction conditions or catalyst systems used in a solvent system such as acetic acid. Furthermore, Vynne Norval, et al. teaches away from a combination with Partenheimer et al. stating that:

> "Unfortunately, under the reaction conditions and with the catalyst usually used in the acetic acid solvent process the use of water as solvent gives a process with very poor yield of an inferior product." page 1, lines 23-26.

For the reasons that Partenheimer et al. and Vynne Norval et al. are directed to solving different problems, e.g. oxidation rate vs. the use of water as a solvent to obtain an acceptable product; and that the solvent systems in each are different which, according to Vynne Norval et al. must be particularized to a defined set of process conditions; it is submitted that the teachings of Vynne Norval et al. and Partenheimer et al. are not combinable.

If one of ordinary skill in the art were to attempt to combine the teachings of Vynne Norval et al. with Partenheimer et al., the combination would not suggest the claimed invention. Vynne Norval et al. does not describe or suggest a catalyst system comprising a source of nickel atoms, a source of manganese atoms, and a source of bromine atoms wherein the stoichiometric molar ratio of bromine atoms to manganese atoms is 1.5 or less. As can be seen from the description of the working examples of Vynne Norval et al., it would appear that the source of bromine comes from adding aqueous HBR and various amounts of cobalt dibromidehexahydrate, manganese dibromidetetrahydrate and nickel dibromidetrihydrate. Combinations of the different compounds added to the oxidation mixture as a catalyst system included manganese, cobalt and bromine, but

not nickel (Examples 1-3), or combinations of manganese, nickel and bromine, but not cobalt (Examples 4-6), and examples of one only one heavy metal, manganese, cobalt, or nickel, and bromine (Examples 7-9). Examples 4-6 each disclose a stoichiometric ratio of bromine to manganese atoms well above 2.0. The reaction mixture contains excessive bromine in that manganese dibromidetetrahydrate is made up of two bromine atoms for each manganese atom and nickel dibromidetrihydrate is made up of two bromine atoms for each nickel atom. The system contains additional bromine from the aqueous HBR charged. Thus, combinations of bromine, nickel, and manganese are not described in terms of a particular ratio of bromine to manganese, and what is disclosed is a reaction mixture with a bromine to manganese stoichiometric ration greater than 2.0. Also the minimum amount of nickel required is not disclosed.

Vynne Norval et al. do not suggest any modification of the catalysts reported in Partenheimer et al. Nor would Vynne Norval et al. have suggested the suitable operating conditions or suitable catalyst compositions that should be used in a solvent system comprised of acetic acid because the operating conditions and catalyst system described by Vynne Norval et al. are particularized to a water solvent system. Moreover, if one were to adopt the teachings of Vynne Norval et al. and use those teachings to modify the teachings of Partenheimer et al. by merely performing a swap of the solvent systems (even though this would be clearly into the arena of obvious to try), those of skill would have continued to employ a catalyst system employing zirconium atoms as taught by Partenheimer et al. For these reasons, it is submitted that Vynne Norval et al. in combination with Partenheimer et al. do not teach or suggest the claimed invention.

Partenheimer et al. and Vynne Norval et al. also do not teach or suggest any of the dependent claims. Specifically, the combination of references do not teach or suggest an acetic acid composition containing 2.5 to 15 wt. % water, and in fact, Vynne Norval et al. would teach a solvent system consisting almost exclusively, if not exclusively, of water. If one were to adopt the teachings of Partenheimer et al. with respect to the acetic acid composition, then all the teachings of Partenheimer et al. have to be adopted including the catalyst compositions that are suitable in such solvents.

The references do not disclose or suggest a molar ratio bromine to nickel at 0.9 or less.

There is no suggestion to employ catalyst composition comprising a source of nickel, a source of bromine, and a source of manganese wherein the stoichiometric molar ratio of bromine atoms to manganese atoms is 1.5 or less, in a catalyst system containing less than 2 ppm zirconium; or containing less than 5 ppm cobalt; or that when such a catalyst system is used, the 4-CBA content is less than 10,000 ppm in the solids; or that the ratio solvent burn is 0.8 moles of CO_x per mole of terephthlate acid produced with respect to the ratio of solvent burn.

It is acknowledged in the Office Action that the prior art is silent about the solvent burn ratio, but it is alleged that analyzers can be used to measure the degree of burn according to Partenheimer et al. However, it is submitted that the mere existence of capabilities to measure the degree of acid burn does not suggest what the ratio of acid burn should be, or what operating conditions are or should be used in order to lower that ratio, or what the operating conditions in combination with a particular catalyst composition should be in order to obtain optimally lower solvent burn, especially in combination with lowered amount of 4-CBA as set forth in claims 20 and 21.

Applicants note that "the examiner made inadvertently some mistakes in the [First] Office Action [and] in order to correct the mistake, the examiner has decided to issue another Non-Final Office Action." Applicant had replied to the First Office Action and traversed examiner's rejections based upon indefiniteness (claims 1-21), novelty (claims 1-14 and 17-19), and obviousness (claims 1-18 and 20-21). Examiner repeated the rejections but did not "take note of the applicant's argument and answer the substance of it." MPEP 707.07(f). Applicants respectfully submit that the Examiner's lack of answer to the substance of Applicant's arguments does not aid in the timely and efficient prosecution of patent applications.

For these reasons, Applicants respectfully request withdrawal of all objections and rejections and allowance of the claims as amended.

Respectfully submitted,

Dennis V. Carmen
Registration No. 35,007

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Date

Eastman Chemical Company
P.O. Box 511
Kingsport, Tennessee 37662
Phone: (423) 229-6189
FAX: (423) 229-1239

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Jo Ann Elam
Jo Ann Elam

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Date